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# NAVAL POSTGRADUATE SCHOOL MONTEREY, CALIFORNIA



## THESIS

ASSIGNING COMMUNITY CRITICALITY  
WEIGHTS TO MARINE CORPS READINESS  
REPORTABLE EQUIPMENT

by

Thomas W. Russell

December 1996

Principal Advisor:

Dave Matthews

Approved for public release; distribution is unlimited.

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**ASSIGNING COMMUNITY CRITICALITY WEIGHTS TO MARINE  
CORPS READINESS REPORTABLE EQUIPMENT**

Thomas W. Russell  
Major, United States Marine Corps  
B.S., Virginia Military Institute, 1986  
M.B.A., Oklahoma City University, 1994

Submitted in partial fulfillment  
of the requirements for the degree of

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**NAVAL POSTGRADUATE SCHOOL**  
**December 1996**

Author:

Thomas W. Russell

Approved by:

Dave Matthews, Principal Advisor

Keebom Kang, Associate Advisor

Reuben T. Harris, Chairman  
Department of Systems Management



## ABSTRACT

The Marine Corps' purpose of reporting equipment readiness ratings is to reflect both the portion of equipment possessed by an organization and the ability to perform its wartime mission. Supply ratings generated by the current methodology do an adequate job of reflecting the portion of equipment available for use, but the readiness ratings fall short of representing the unit's true war-fighting ability. The current method used to compute readiness ratings reflects the percentage, or fraction, of readiness reportable items rated that are on-hand and in an operational condition. Under this method, any reportable item that is declared as being in a deadlined maintenance condition will impact the readiness rating with an equal weight, regardless of the critical nature of the item. This thesis proposes a better way of computing the readiness rating in order to ensure it represents the true war-fighting capability of the unit instead of a mere percentage of available equipment. The study involves assigning "community criticality weights" to Marine Corps reportable equipment that will reflect the critical nature of an item in terms of the war-fighting mission assigned to the organization that possesses it. When a piece of equipment becomes deadlined, the community criticality weight will be considered when generating readiness ratings. A broken item will, therefore, influence the readiness rating by a magnitude that is commensurate with the item's community criticality weight. The readiness rating will now bear a closer approximation to the war-fighting ability of the unit than the rating generated under the current method and it will ensure that the priority of the maintenance effort is focused on those items that will provide the maximum benefit to mission accomplishment.



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## I. INTRODUCTION

### A. BACKGROUND

Today's international geopolitical scene, along with changes in U.S. defense orientation since the end of the Cold War, have required the United States Marine Corps (USMC) to be prepared to respond to new and challenging missions. In addition to traditional missions such as protecting U.S. national interests abroad and force projection, America's "Force-in-Readiness" must be prepared to execute "military operations other than war" (MOOTW) type taskings which include humanitarian relief, civilian evacuation, drug interdiction, and support to civil authorities [Ref. 1:p. 56]. Because of this current requirement, the operational tempo experienced by USMC combat units is higher today than it has been in decades. In fiscal year 95 alone, the Marine Corps participated in 15 real-world operations and 297 exercises [Ref. 1:pp. 54-55]. In order to ensure that Marine Corps units are prepared to respond to these missions, it is imperative that a high level of readiness be maintained by each Fleet Marine Force (FMF) organization and that it be accurately reported up the chain of command.

All FMF organizations continuously report readiness ratings up the chain of command all the way to the Joint Chiefs of Staff (JCS) level in order to provide a realistic portrayal of their capability to perform their assigned wartime mission [Ref. 2:p. 1-3]. The Marine Corps defines readiness as "the ability of forces, units, weapon systems, or equipment to deliver the output for which they were designed" [Ref. 2:p. B-1]. There are three parts to readiness: manpower, money, and materiel. Materiel, or equipment, readiness will be the focus of this study and is defined by the Marine Corps as "the portion of the unit's equipment or ability to perform its mission as determined by the condition of the equipment resources allocated to the unit" [Ref.

3:p. 1-6]. This definition has two parts. The first part addresses the portion of equipment that is available to the unit, and the second deals with the unit's ability to perform its mission as determined by the equipment condition. It is important that the Marine Corps' methodology of computing and reporting equipment readiness remains faithful to both parts of this definition.

## **B. OBJECTIVE OF THE RESEARCH**

The current method used by the Marine Corps to compute equipment readiness does a good job for showing the portion of a unit's equipment that is available, but does not reflect the ability of the unit to perform its wartime mission. Equipment readiness reported by a Marine Corps unit is reflected by a percentage figure. It measures the fraction of mission essential equipment that is both on-hand, and in a mission capable maintenance status. Should an item break, regardless of the criticality of the item to that specific unit, it will negatively impact the equipment readiness figure with the same weight.

The impact that a broken piece of equipment has on the ability of a unit to perform its wartime mission, depends on the relationship between the broken item and the purpose of the unit. For example, a broken encryption device will have a larger negative impact on the ability of a communications battalion to function than it would have on an infantry battalion. On the other hand, a broken .50 cal machine gun will have a heavier impact on the ability of an infantry unit to function than it would on a communications battalion. A tank battalion's ability to perform its wartime mission will be degraded significantly more by the loss of an M1A1 main battle tank than it would by a broken MEP-003 generator. However, under the current method of computing equipment readiness ratings, the negative impact would be the same for both items.

The objective of this research is to investigate the development of a better method of computing ground equipment readiness that will reflect not only the portion of equipment available to a unit, but also the ability of the unit to perform its mission as determined by the maintenance condition of its equipment. The research will attempt to associate a specific community criticality weight to a piece of equipment that is relative to the criticality of the item in terms of that community's mission or purpose. The weight will be considered when the equipment readiness rating is computed in order to reflect the impact of that broken item on the unit's ability to function.

### **C. RESEARCH QUESTIONS**

Based on the aforementioned objective, in this thesis we will address one primary question and three secondary questions:

#### **1. Primary Question**

Can the current method used to compute equipment readiness for USMC organizations be modified in order to produce a figure that reflects "ability", not just "portion"?

#### **2. Secondary Questions**

a. What is the distribution of readiness reportable items throughout the FMF?

b. How does the criticality of a piece of equipment vary among the different FMF communities?

c. How can the equipment criticality variability between communities be reflected in the computation of an organization's equipment readiness?

### **D. SCOPE AND LIMITATIONS**

The main thrusts of this study are to: (1) construct a matrix that shows the criticality distribution of a piece of equipment among the different FMF communities,

and (2) modify the method used to compute equipment readiness ratings in order to consider the criticality of a broken item. This will require obtaining prioritized lists of the rankings of readiness reportable equipment as determined by the different communities. We will examine active USMC ground communities only, as the focus of this thesis is on ground equipment readiness. Aviation readiness for the Marine Corps is generated and reported via U.S. Navy's Aircraft Material Readiness Report (AMRR) and will not be addressed in this study [Ref. 4]. Data collection will be concentrated from the I Marine Expeditionary Force located at Camp Pendleton, California. New methods of computing equipment readiness and changes to readiness report formats to accommodate the new method will be proposed based on the information contained within the matrix.

#### **E. ORGANIZATION OF THE THESIS**

Chapter I provides a general background of why readiness is so important to the Marine Corps. It also examines the inadequacy of the current method of computing equipment readiness ratings in reflecting the ability of an organization to perform its assigned mission. Chapter II will closely examine how equipment readiness ratings are currently computed and reported up the chain of command and also present a scenario that will amplify the problems with this method. Chapter III will discuss proposed improvements for computing ground equipment readiness. Chapter IV will outline the methodology to be used to institute the proposed improvements and will present a completed matrix that depicts the relationship between the criticality of every readiness reportable item to the different USMC ground communities that rate the item. Modifications to the current method of computing equipment readiness ratings will be proposed along with accompanying changes to the equipment readiness report format. Chapter V will show how this new method of computing ground equipment readiness differs from the current

methodology by examining the same scenario presented in Chapter II, applying the proposed methodology to compute readiness figures, and comparing the results. Four new scenarios, each comparing deadlined equipment from two similar units belonging to the same community, will be looked at and a survey will be conducted asking USMC officers to indicate which unit is considered more capable of performing its wartime mission. Readiness ratings will be generated using both the current and proposed methodologies and compared with the survey results. Chapter VI will provide a summary, conclusions, offer recommendations, and discuss opportunities for further study.



## **II. CURRENT SYSTEM AND PROBLEM SCENARIO**

This chapter examines the current methodology employed by the Marine Corps to compute equipment readiness. It identifies and explains the automated report that is used by Fleet Marine Force organizations to report ground equipment readiness to higher headquarters. The chapter concludes with a problem scenario presented to highlight problems with the current methodology used to compute ground equipment readiness.

### **A. DEFINITIONS**

In this section we provide definitions of terminologies needed to understand the current methodology of computing and reporting ground equipment readiness.

#### **1. Allowance Items**

Refers to the quantity of items of supply or equipment prescribed by Marine Corps Tables of Equipment or other authorized allowance publications. [Ref. 5:p. A-1]

#### **2. Commodity Area**

Refers to a grouping or range of items which contain similar characteristics, have similar applications, and are susceptible to similar logistics management methods. Examples include motor transport, communications, ordnance, etc. [Ref. 3:p. 1-7]

#### **3. Deadlined Equipment**

Equipment is considered deadlined when it is not mission capable; that is, it cannot perform its designed combat mission due to the need for critical repairs. [Ref. 3:p. 1-7]

#### **4. Item Designator Number (ID Number)**

A number assigned to identify an equipment end item down to the specific model or variant.

#### **5. Marine Corps Integrated Maintenance Management System (MIMMS)**

The mechanized automated information system used by the Marine Corps to provide for maintenance production management. [Ref. 5:p. A-15]

#### **6. Not Mission Capable**

A term describing the equipment condition/status which indicates that it cannot perform its designed primary function, synonymous with "deadlined." When equipment is not mission capable, it will be reported in one of two ways. Not Mission Capable Maintenance (NMCM), indicates that an item is not mission capable because of a lack of personnel, space, or tools. Not Mission Capable Supply (NMCS), indicates the item is awaiting repair parts. [Ref. 3:p. 1-6]

#### **7. Status of Resources and Training System (SORTS)**

An internal management system used by the Department of Defense that indicates, at a selected time, the status of a unit's personnel resources, amount and condition of equipment, and the level of unit training relative to service standards. [Ref. 2:p. 1-3]

### **B. MARINE CORPS AUTOMATED READINESS EVALUATION SYSTEM (MARES)**

The ground equipment readiness of FMF organizations is monitored via the Marine Corps Automated Readiness Evaluation System (MARES). This information system is a subset of the Marine Corps Integrated Maintenance Management System (MIMMS), which integrates supply and maintenance data to provide information concerning the ground equipment of active FMF units. The MARES receives, processes, and stores data which reflects the maintenance status of selected ground

equipment as well as identifies excesses and deficiencies of reportable equipment. The MARES data is also used as input for the Status of Resources and Training System (SORTS) reporting. [Ref. 2:p. 1-3]

Not all USMC equipment is monitored by MARES. The Marine Corps publishes an annual list of those mission-essential war-fighting pieces of equipment that have a direct impact on readiness and are to be reported, via MARES, to Headquarters Marine Corps (HQMC). This list can be found in the Marine Corps bulletin (MCBul) 3000 series entitled "Table of MARES Logistics Reportable Items for the SORTS". Items included in the Bulletin fall into one of the following categories:

### **1. Reportable Equipment**

An item of equipment contained in the MCBul 3000 series. Before items can be included in this Bulletin, they must be mission-essential principal end items that are 85 percent fielded Marine Corps-wide, nominated for MARES reporting by either the field commands or HQMC, and accepted for inclusion by the Commandant of the Marine Corps (CMC). [Ref. 3:p. 1-5]

### **2. Pacing Items**

Combat essential primary weapon system(s) assigned to the unit to accomplish its wartime mission. Pacing items are of such importance that they are subject to continuous monitoring and management at all levels of command [Ref. 3:p. 1-6]. These items can be considered as "Super" reportable equipment. Pacing item designation varies among the different war-fighting communities depending on specific missions.

MARES monitors and reports maintenance readiness figures as well as excesses and deficiencies for reportable equipment, to include pacing items. The system also separately reports the same figures for the pacing items only.

### **C. TABLE OF AUTHORIZED MATERIEL CONTROL NUMBER (TAMCN)**

All major end items of equipment are assigned and identified by a Table of Authorized Materiel Control Number (TAMCN) within the Marine Corps. The TAMCN is more broad than the ID Number as one TAMCN may encompass several ID Numbers. In its basic form, a TAMCN is a five-digit alphanumeric number that identifies the commodity area to which the item is associated and indicates whether the item is considered a Type 1, Type 2 or Type 3 piece of equipment. All Marine Corps equipment can be classified as one of the three types. The following is an explanation of these three types of equipment:

Type 1 Equipment: War-fighting items that are directly utilized to accomplish the mission. All units must have on hand or on valid requisition all type 1 allowances. [Ref. 6:p. 11-4]

Type 2 Equipment: Items used for garrison and encampment use only. A unit may possess up to the allowance quantity for type 2 items. [Ref. 6:p. 11-4]

Type 3 Equipment: Items used in a desert or arctic environment. These items are all maintained in centrally held contingency equipment training pools and are issued as needed. [Ref. 6:p. 11-4]

All TAMCNs begin with an alpha character and are followed by four digits. The alpha character identifies both the commodity and type. The next four digits are numerical and merely reflect the order in which items were originally catalogued. The following table displays the appropriate TAMCNs assignable by commodity and type:

**Table 2.1. TAM Control Number Assignment [Ref. 6:p. 11-5]**

Commodity	Type 1	Type 2	Type 3
Communication/ Electronics	A0000-A9999	H0000-H9999	T0000-T9999
Engineer	B0000-B9999	J0000-J9999	U0000-U9999
General Supply	C0000-C9999	K0000-K9999	V0000-V9999
Motor Transport	D0000-D0000	M0000-M9999	W0000-W9999
Ordnance	E0000-E9999	N0000-N9999	X0000-X9999

All readiness reportable items are Type 1 major end items and are identified in the MCBul 3000 series by their respective TAMCN.

#### **D. LM2 UNIT REPORT**

MARES receives readiness figures for FMF units based on what is generated by the LM2 report. Each FMF unit that has an allowance for readiness reportable equipment will automatically have an LM2 report generated for them by MIMMS. The LM2 report is a listing that reflects each readiness reportable TAMCN rated by the unit, the quantity authorized, the quantity possessed, and any excesses, if applicable. A negative statement is provided when no equipment is reported deadlined for that TAMCN. On all deadlined items, the serial number and other pertinent maintenance information is printed [Ref. 5:pp. 17-35]. Totals of authorized, possessed, excess, and deadlined items are printed at the end of the report. The S (Supply) and R (Readiness) ratings are generated for all reportable equipment and then again for only pacing items. If the pacing item percentages for S and R ratings are lower than those generated for all reportable equipment, the organization will report that lower percentage rating. [Ref. 7:para 6.E] Figure 2.1 shows a notional LM2. The following information describes the contents of this report:

Figure 2.1. Notional LM2 Report

12

MARES LM2 UNIT REPORT  
HQ 19TH MAR

UIC PAGE 1 MC PAGE 56

UIC M12301										MAJOR CMD M12000				
TAM NUMBER	TAM NOMENCLATURE	REPT AUTH	REPT POSS	DEADLINED-EQUIP	ORIGINAL DATE-DL	DATE-OF PRES-COND	PRES COND	PRES EOM	PRESENT HOLDER	STATUS DAYS	ERO NO			
				SERIAL-NO	ID-NO									
B2462	TRACTOR, MED, FULL TRACK, D7G	6	6	NONE REPORTED ON DEADLINE REMARKS ABOUT TAM										T/E=006
'D1059	5-10N TRK M813	50	49	5475371	8087B	96/115	96/126	NMCM	2	M12301	000	AUL54		
				558264	8262A	96/221	96/221	NMCM	4	M14330	005	LN673		
				558354	8262A	96/108	96/124	NMCS	2	M12301	002	AUN61		
										REMARKS ABOUT TAM				
										T/E=054 QTY 001 SHIPPED TO MCLB R&R DPYD QTY 004 TO M20181				
D1158	TRK CARGO, HMMWV M998/1038	32	33	529042	8770A	96/125	96/125	NMCS	2	M12301	001	AUG61		
				535035	8770A	96/125	96/125	NMCM	2	M12301	001	AUG65		
				535263	8770A	96/120	96/126	NMCS	2	M12301	000	AUG64		
										REMARKS ABOUT TAM				
										T/E=032 PLANNED ALLOW OF 010 FY97 QTY 001 RCVD AND ON HAND				
D1212	WRECKER M816/M936	2	2	550910	8780A	96/041	96/059	NMCS	2	M12301	067	AUP40		
										REMARKS ABOUT TAM				
										T/E=002				
'E0980	MACH GUN CAL 50 M2	10	10	NONE REPORTED ON DEADLINE REMARKS ABOUT TAM										T/E=010
E1158	NIGHT VISION SIGHT INDIV SERVD	6	6	NONE REPORTED ON DEADLINE REMARKS ABOUT TAM										T/E=006

Figure 2.1 (Continued)

Figure 2.1 (Continued)

UIC M12301										MAJOR CMD M12000				
TAM NUMBER	TAM NOMENCLATURE	REPT AUTH	REPT POSS	DEADLINED-EQUIP		ORIGINAL DATE-DL	DATE-OF PRES-COND	PRES COND	PRES EOM	PRES HOLDER	STATUS DAYS	ERO NO		
										SERIAL-NO	ID-NO			
E1210	PADS AN USQ-70	3	5	2	0202 0209	8837A 8837A	96/122 96/216	96/122 96/218	NMCM NMCS	2 3	M12301 M22910	004 273	WW285 LAE95	
REMARKS ABOUT TAM														
T/E=003 T/E EXCESS QTY 002 PENDING MOA														
TOTALS FOR THIS UIC ARE				179	180	3	QTY DL = 11							
PACING ITEM READINESS							END ITEM READINESS							
S RATING EQUALS 98.33 PERCENT							S RATING EQUALS 98.87 PERCENT							
R RATING EQUALS 93.33 PERCENT							R RATING EQUALS 93.89 PERCENT							
<small>'- PACING ITEM "- LOCALLY REPORTABLE ITEM</small>														
$S \text{ RATING} = \frac{\text{POSS-EXCESS}}{\text{AUTH}}$														
$R \text{ RATING} = \frac{\text{POSS-DL}}{\text{POSS}}$														

## 1. Header Information

The header identifies the effective date of the report by displaying the calendar year/Julian date. The unit this report pertains to is identified as the headquarters element of the 19th Marine Regiment, Unit Identification Code (UIC) M12301. They are part of the major command identified by UIC M12000.

## 2. Legend

Data is portrayed in the body of the report as follows: [Ref. 5:pp. 17-35, 17-36]

- **TAM.** This column displays the appropriate TAMCN. Notice the report is presented in TAMCN sequence.
- **TAM NOMENCLATURE.** This column displays the name of the equipment.
- **REPT AUTH.** The quantity authorized by the unit for each TAMCN is displayed. This quantity will be determined by appropriate tables of equipment and/or special allowances.
- **REPT POSS.** The on hand quantity as reported by the units supply section is displayed. Ideally, the possessed quantity should equal the authorized quantity.
- **EXCESS QTY.** This column displays the amount of equipment for each TAMCN which the unit has on hand over the amount authorized.

\*Note: If there are no items reported deadlined for a TAMCN, the statement "None Reported on Deadline" will appear and the following fields will be blank.

- **DEADLINED EQUIP.** The serial number and ID Number of unit equipment for each TAMCN that is reported in a deadlined status is displayed.
- **ORIGINAL DATE-DL.** The date the item was placed in a Not Mission Capable Status is displayed.

- **DATE-OF-PRES-COND.** This column displays the date of the most frequent change in readiness condition of the deadlined item.
- **PRES COND.** This column indicates whether the deadlined item is currently in a "NMCS" or "NMCM" readiness posture.
- **PRES EOM.** The echelon of maintenance that is performing maintenance on the deadlined item is displayed.
- **PRES HOLDER.** The UIC of the organization performing maintenance on the deadlined item is displayed. If the item is at the organizational level, the owning unit UIC will be displayed. If the item is at the intermediate level, the intermediate shop UIC will be displayed.
- **STATUS DAYS.** The number of days the deadlined has been in its current readiness posture is displayed.
- **ERO NO.** This column displays the Equipment Repair Order Number under which the item was inducted into the maintenance cycle. If the item is at the intermediate level, the intermediate ERO number will be displayed.

### 3. RM4 Remarks

Since the LM2 is a high visibility report, reviewed by the chain of command and HQMC, the owning unit is permitted to make clarifying comments about any TAMCN. Such comments are referred to as RM4 remarks. Anytime there is a discrepancy between the authorized and possessed quantities for a particular TAMCN, disposition efforts of the excess items, or requisition status of the deficiency must be explained in an RM4 remark. Other examples that warrant clarification in an RM4 remark include articulating the location of deployed reportable equipment or providing details on the possessed quantities of different models/variants of a particular TAMCN.

#### **4. Ratings**

At the conclusion of the report, supply and readiness ratings are computed for pacing items and then for all reportable end items. Formulas for "S" and "R" ratings are found at the bottom of the report. The "S" rating reflects the fraction of the total authorized items that are being reported as on hand. The "R" rating reflects the fraction of possessed items that are in working condition. The lowest ratings generated from either end items or pacing items data are forwarded as input for the equipment readiness portion of MARES.

#### **E. PROBLEM SCENARIO**

The following scenarios are designed to highlight problems with the current methodology of computing ground equipment readiness:

##### **1. 3rd Battalion, 10th Marines (3/10)**

3/10 is an artillery battalion located at Camp Lejeune, North Carolina. The battalion is authorized 210 pieces of readiness reportable equipment, 77 of which are pacing items. They are reporting two pieces of equipment deficient, a D1059 5-ton truck, which is a pacing item for this unit, and an A2065 HF radio, for a total possessed quantity of 208. They have no excess items on hand. In addition to the two deficiencies, 3/10 is reporting 21 readiness reportable items in a deadline status consisting of the following:

<b>TAMCN</b>	<b>Nomenclature</b>	<b>DL Qty</b>
A2065	Radio Set, AN/PRC-104	1
A2069	Radio Set, AN/PRC-113	1
A2167	Radio Set, AN/VRC-88A	4
A8082	GP, Tele Equip, TSEC/KG-84A	6

B0953	Generator, MEP-005A	3
B1021	Generator, MEP-006	2
D1059	5-Ton Truck, M813	3 (Pacing Item)
E1158	Night Vision Goggles	1

Per the rating formulas identified at the bottom of Figure 2.1, 3/10 would be reporting the following supply and readiness ratings:

<u>Pacing Items</u>	<u>End Items</u>
S Rating Equals 98.70	S Rating Equals 99.05
R Rating Equals 96.05	R Rating Equals 89.90

## 2. 2nd Battalion, 10th Marines (2/10)

2/10 is a sister artillery battalion to 3/10 and is also located at Camp Lejeune. 2/10 has an identical table of equipment as 3/10 and is also authorized 210 pieces of readiness reportable equipment, 77 of which are pacing items. The battalion is deficient only one item, an E0665 M198 howitzer, which is a pacing item. The battalion is excess one D1059 5-ton truck, also a pacing item, and one B0953 MEP-005 generator. 2/10 is reporting 17 pieces of readiness reportable equipment in a deadline status consisting of the following:

<b>TAMCN</b>	<b>Nomenclature</b>	<b>DL Qty</b>
A1935	Radio Set, AN/MRC-138B	1
A2065	Radio Set, AN/PRC-104	2

A2070	Radio Set, AN/PRC-119A	3
A2508	Switchboard 3862	1
B0891	Generator Set, MEP-003	3
D1158	Truck, HMMWV, M998	3
E3250	Radar Chronograph, M-90	1
E1210	AN/USQ-70	1
E0665	Howitzer, M198	2 (Pacing Item)

Per the rating formulas identified at the bottom of Figure 2.1, 2/10 would be reporting the following supply and readiness ratings:

<u>Pacing Items</u>	<u>End Items</u>
S Rating Equals 98.70	S Rating Equals 99.52
R Rating Equals 97.40	R Rating Equals 91.94

### **3. Equipment Readiness Comparison**

By observing only the supply and readiness ratings for each battalion, one would conclude that 2/10 is more capable and should be the unit of choice for deployment in a contingency situation in terms of equipment readiness. But is 2/10's ability to perform its wartime mission greater than that of 3/10? The Marine Corps has defined the mission of an artillery battalion as being able to "provide direct support, general support, reinforcing, general support reinforcing fires to support a Marine Air Ground Task Force (MAGTF) conducting combat operations." [Ref. 8:para 3] In light of this mission statement, the most critical piece of equipment an

artillery unit owns is the M198 howitzer [Ref. 9]. An artillery battalion rates 18 howitzers and 2/10 only has 15 operational while 3/10 has all 18. Howitzers and their ammunition are moved around the battlefield by the 5-ton truck. An artillery battalion rates 59 5-ton trucks. 2/10 has 60 available for use and 3/10 has 56 [Ref. 10]. Although not pacing items, the AN/USQ-70 and the M-90 chronograph both have a significant impact on the ability to execute the war-fighting mission of an artillery unit, as defined above, which exceeds that of most other readiness reportable items [Ref. 9]. 2/10 is reporting one of each in a deadline status while 3/10 has all available.

When determining an organization's "ability" to perform its wartime function, the criticality of the deadlined equipment as it relates to the units mission needs to be considered. Although in the above scenario, 3/10 has lower supply and readiness ratings than its sister battalion, it is arguably more combat ready since more of its critical war-fighting assets are available. In terms of equipment readiness, 3/10 should be the unit of choice for deployment in a contingency situation. Consideration of the critical nature of the equipment as it relates to a unit's mission needs to be reflected in the supply and readiness ratings so that these ratings capture the true "ability" of a unit to carry out its assigned mission. The current method of computing "R" ratings falls short of doing this. Furthermore, the current method fails to incentivize accomplishing repairs on critical assets over those that are less vital. 2/10 could improve their already inflated readiness rating by repairing their two A2065 AN/PRC-104 radios and the A2508 switchboard, both readiness reportable items but not considered as vital to mission accomplishment as other reportable items [Ref. 9]. This would increase their end item readiness to 93.36, although considering the very critical nature of the other deadlined items, 2/10's ability to perform their war-fighting mission will have insignificantly improved by the repair of the these three

communication items. Because the current method allows each reportable item to impact the readiness rating with equal weight, it not only fails to represent war-fighting ability, but fails to motivate the allocation of maintenance resources towards the repair of the most critical assets as well.



### **III. PROPOSED READINESS RATING IMPROVEMENTS**

The Marine Corps states that the purpose of readiness reporting is to "provide a realistic portrayal of a unit's capability to perform its assigned wartime mission" [Ref. 2:p. 1-3]. When a piece of equipment is placed in a non-mission capable status, the magnitude of the negative impact that the loss of that item has on the organization's capability to function, needs to be captured in the equipment readiness rating associated to that unit. As discussed in the previous chapter, the current methodology falls short of doing this. With some modification to this methodology, the Marine Corps can gain the "realistic portrayal of a unit's capability to perform its assigned wartime mission" in terms of ground equipment readiness, that it seeks.

#### **A. COMMUNITY VERSUS READINESS REPORTABLE EQUIPMENT MATRIX**

The impact that a piece of readiness reportable equipment has on a unit's ability to perform its wartime mission will vary depending on the nature of the mission. This variability can be captured in the computation of readiness ratings by applying a community criticality weight to every piece of readiness reportable equipment. This weight will be determined from a matrix depicting how a readiness reportable item relates to each Marine Corps community in terms of criticality. Should an item be placed in a non-mission capable status, the community criticality weight will be considered when computing readiness ratings.

##### **1. Community Designation**

Each Marine Expeditionary Force contains three ground major subordinate commands: the Marine Division; the Force Service Support Group (FSSG); and the Surveillance, Reconnaissance, and Intelligence Group (SRIG) [Ref. 11:p. 16]. Each major subordinate command is comprised of different communities. A community

consists of units that have been assigned similar wartime missions and have similar priorities as well as equipment. The initial task in developing community criticality weights is to separate the MEF into distinct communities.

## **2. Equipment Association**

Each readiness reportable piece of equipment needs to be associated to each community that rates the item. A community may very well be comprised of multiple units. The tables of equipment (T/Es) of each unit that make up a community will have to be consulted so that every readiness reportable item belonging to that community can be flagged. A matrix will be constructed reflecting the different Marine Corps communities across the horizontal axis and the TAMCN of all readiness reportable equipment down the vertical axis. At this point, the body of the matrix will show which TAMCNs are associated with which communities.

## **3. Ranking of Readiness Reportable Equipment**

Each community will be solicited by the author to provide a ranking of its associated readiness reportable equipment in terms of the criticality of each item to the assigned wartime mission of the community. From the matrix, associated readiness reportable equipment will be extracted, in TAMCN sequence, for each community. Community advocates will be identified and the lists forwarded to them for prioritization. Upon receipt of the rankings from the communities, the matrix will be updated so the body not only shows which TAMCNs are associated to which communities, but will indicate where each TAMCN falls in terms of criticality ranking for each community.

## **B. COMMUNITY CRITICALITY WEIGHTS USING ABC CLASSIFICATION**

Community rankings of readiness reportable equipment will be assigned a criticality weight that is determined by applying ABC classification. This classification method involves grouping items together in decreasing order as determined by some criteria. The criteria used in this study will be the criticality ranking. This array

is then split into several classes. For the purpose of defining ABC classification we'll assume three classes, called A, B, and C. The A class will comprise the top 10% to 20% of the most critical items, as ranked by each community; the B group will comprise the next 20% to 30% of the most critical items; and the C class will encompass the bottom 50% to 60% of the rankings [Ref. 12:p. 1]. When an item is placed in a non-mission capable status, the magnitude of the negative impact on the organization's reported equipment readiness will be determined by the class to which the piece of equipment is associated for that community. An item belonging in the A class will have a greater impact on equipment readiness than an item associated with the C group. It is possible that an item could belong in the A group for one community and be in the C class for a different community.

All items of a common class will be assigned the same community criticality weight. The weight will represent the multiplier applied to the computation of equipment readiness should an item become deadlined. In the case of our example above, all A class items might be given a weight of 3, all B class items a weight of 2, and items in the C group a weight of 1. These community criticality weights will then be placed into the body of the matrix in place of the community rankings. The matrix will now demonstrate how a piece of equipment relates to a community in terms of criticality. It will also display the variability in the criticality of an item across the different USMC ground communities.

### **C. LM2 RATING FORMULA MODIFICATIONS**

The LM2 report is the vehicle used to compute and report ground equipment readiness. The Marine Corps' definition of equipment readiness encompasses the portion of equipment that is available to the unit and the unit's ability to perform its mission as determined by the equipment condition. Minor changes to the current

readiness formula are required to accommodate the use of community criticality weights when computing readiness ratings that comply with this definition.

### **1. Supply Ratings**

The "S" rating that is currently computed by the LM2 is generated by the following formula:

$$\text{"S" rating} = [(\text{POSS QTY} - \text{EXCESS QTY}) / \text{AUTH QTY}]$$

This formula does an adequate job of satisfying the first part of the equipment readiness definition. The rating generated by the respective formula accurately reflects the portion of readiness reportable equipment that the unit is reporting "on hand." No changes are needed for this rating.

### **2. Readiness Ratings**

The method of computing the "R" rating needs to be modified in order to consider the community criticality weight of a particular deadlined item and to capture the true war-fighting ability of a particular unit as determined by the equipment condition. The current "R" rating formula merely computes the fraction of possessed equipment that is in an operational maintenance condition and is depicted as follows:

$$\text{"R" rating} = [(\text{POSS QTY} - \text{DL QTY}) / \text{POSS QTY}]$$

Capturing the importance of a deadlined item in the computation of readiness ratings can be accomplished by utilizing a weighted average technique. This technique involves assigning a weighting factor to a parameter prior to evaluation. The degree of importance of a parameter will determine the magnitude of the weighting factor. The parameters that apply to the readiness formula will be deadlined items. The most important items will receive the heaviest weight [Ref. 13:p. 157]. The criticality weights generated from community rankings of reportable equipment

will be used as the weighting factors when applying this technique. The following modifications to the current formula will occur:

- Instead of using the possessed quantity (POSS QTY), use a possessed weight (POSS WT) which equals the sum of the product of the possessed quantity multiplied by the community criticality weight for each TAMCN.
- Instead of using the deadlined quantity (DL QTY), use a deadlined weight (DL WT) which equals the sum of the products of each deadlined item multiplied by its respective community criticality weight.

The modified formula would be depicted as follows:

$$\text{"R" rating} = [(POSS WT - DL WT) / POSS WT]$$

The LM2 report format will have to be modified as well in order to accommodate the new readiness rating formula.



## **IV. METHODOLOGY AND MATRIX**

This chapter discusses the methods used by the author to accomplish the proposed improvements. The matrix mentioned in Chapter III that depicts community criticality weights for all readiness reportable equipment and all ground communities will be presented. Modifications to the LM2 report that will permit consideration of the community criticality weight in the computation of equipment readiness ratings will be proposed.

### **A. COMMUNITY DESIGNATION**

The negative effect that a piece of deadlined equipment has on an organization's capability to perform its wartime mission will be commensurate for those organizations having similar missions and weapons systems. The first task is to identify and associate the various ground FMF organizations into distinct communities consisting of units with similar missions and equipment.

#### **1. Review of Marine Corps Tables of Equipment**

The Table of Equipment System is a software package maintained by the Marine Corps Combat Development Command (MCCDC) located in Quantico, Virginia. This program utilizes organization and equipment data that is maintained by the logistics plans and policy office of HQMC and is designed to provide fast and easy access to USMC table of equipment data [Ref. 14]. "Print all T/Es" is an option available from the main menu. The output from this option provides a listing of every Marine Corps T/E number along with the descriptive name. Armed with this listing, all FMF ground T/Es can now be reviewed and consolidated into communities having similar missions and priorities.

## 2. Ground Communities

Table 4.1 contains the 20 communities that were identified and the parent major subordinate command.

**Table 4.1. USMC FMF Ground Communities**

Marine Division	Division Headquarters Infantry Artillery Tank Light Armored Reconnaissance Assault Amphibian Combat Engineer
Force Service Support Group	FSSG Headquarters Maintenance Landing Support Engineer Support Supply Motor Transport Medical
Surveillance, Reconnaissance, and Intelligence Group	SRIG Headquarters Signals Intelligence Communications Intelligence ANGLICO Force Reconnaissance

Appendix A provides a list of all these communities and the T/E numbers that are associated to each.

## B. EQUIPMENT ASSOCIATION

The Marine Corps has, literally, thousands of different types of equipment in its inventory. Only a select few, however, are considered readiness reportable. The

next tasks are to identify these readiness reportable items, associate each to the communities that rates them, and initiate an equipment versus community matrix.

### **1. Marine Corps Bulletin 3000**

Every year, HQMC publishes the MCBul 3000, Table of Marine Corps Automated Readiness Evaluation System Logistics Reportable Equipment. This bulletin identifies the mission essential principal end items along with combat essential equipment items selected for equipment status reporting within the Marine Corps in support of SORTS [Ref. 7:pp. 1-2]. It identifies, in TAMCN sequence, all readiness reportable end items. If an item is to be considered a pacing item for a specific organization, their T/E number will appear adjacent to the TAMCN.

The MCBul 3000 was used to identify all readiness reportable equipment belonging to the ground FMF. The current edition lists 186 TAMCNs as readiness reportable. Those items that applied only to the aviation communities were disregarded. There remained 146 readiness reportable items belonging to the ground communities.

### **2. Matching Equipment with Communities**

Each TAMCN was reviewed in the Table of Equipment System software. Another option from the main menu of this program was "Review Single TAMCN". The output from this option displayed all T/E numbers that rate an entered TAMCN [Ref. 14]. All 146 readiness reportable pieces of equipment were run through this option. An item was associated to a particular community if a T/E number belonging to the community rated the item.

### **3. Building the Initial Matrix**

With the identification of the ground communities and the readiness reportable equipment associated to each, an initial matrix was ready to be established. Across the horizontal axis, the 20 different communities were listed. Readiness reportable

equipment was listed down the vertical axis in TAMCN sequence. The body of the matrix was filled with "Xs" to merely identify which equipment was associated to which communities.

### **C. RANKING AND CLASSIFICATION**

The most important element of this study was acquiring accurate rankings of each community's readiness reportable equipment in terms of that community's mission. The ranking was the driver to community criticality weight assignments.

#### **1. Community Advocate Solicitations**

The collection of rankings of readiness reportable equipment was concentrated at the Marine Expeditionary Force located at Camp Pendleton, California. This area was chosen due to its close proximity to Monterey should travel be required and because it shared the same time zone. All communities were represented at this location except the signals intelligence community. The Second Radio Battalion located at Camp Lejeune, North Carolina was solicited for this input. Current FMF members of each community were contacted to solicit prioritized rankings of readiness reportable equipment. Community advocates were contacted verbally and provided with a fax copy of the authorized readiness reportable equipment listed in TAMCN sequence. Advocates were instructed to provide a prioritized ranking of the list in terms of the community's mission. As rankings were received from each community, the equipment versus community matrix was updated to reflect the ranking. Appendix B contains the points of contact for each community who forwarded rankings in support of this thesis.

#### **2. Community Criticality Weight Assignment**

The theory behind ABC classification, as described in Chapter III, was applied to each community's ranking. Instead of dividing the list into three groups, however, four groups were used to better distribute the disparity in criticality among the

different items. Those items that were ranked in the top 10 percent were assigned a criticality weight of 4. Items that fell between the top 10 and 25 percent were assigned a weight of 3. A weight of 2 was given to items that ranked between the top 25 to 50 percent. All items that were ranked below the 50 percent mark were given a criticality weight of 1. The community criticality weight represented the order of magnitude that an item has on an organization's ability to execute their wartime mission. An item with a weight of 4 that is declared deadlined will have four times the negative impact on the units equipment readiness than an item with a weight of only 1. Criticality weights were placed into the matrix based on the above criteria for each community. Appendix C displays the final matrix.

The matrix did an outstanding job of articulating how the criticality of an item can vary across the different ground communities. Every community rated TAMCN D1158 which is a High Mobility Multi-Wheeled Vehicle (HMMWV). A community criticality weight of 4 was assigned to this item by three communities, and yet five communities ranked the item in the bottom 50 percentile and a weight of 1 was assigned. Three ordinance items, E0980, M2 .50 caliber machine gun; E0989, M240G machine gun; and E0994, MK-19 40mm machine gun were rated by almost all communities. If we look at the spread of criticality weights, we see that those communities associated to the Division generally rated them higher; those associated to the FSSG generally rated them lower. An engineering item such as the B0953, MEP-005 generator, was rated high by the FSSG and SRIG communities but much lower by Division communities. In any case, the variability of the impact that an item has on the missions of the different FMF ground communities is clearly visible.

## **D. INCORPORATION OF COMMUNITY CRITICALITY WEIGHTS INTO THE LM2 REPORT**

Consideration needs to be given to the community criticality weight of a deadlined item when computing an organization's equipment readiness. The previous chapter discussed recommended changes to the methodology of computing readiness ratings required to incorporate the community criticality weight. Changes that are needed in the LM2 report format to accommodate the change in methodology will be examined in the following:

### **1. Individual Community Criticality Weight**

The community criticality weight must have visibility when a deadlined item is listed on a units LM2 report. A field entitled "CC WT" should appear between the equipment ID number and the original date deadlined. The value placed here will come from the matrix and will represent the magnitude of the negative impact that the deadlined item has on the organization's equipment readiness.

### **2. Average TAMCN Community Criticality Weight**

The average community criticality weight of each TAMCN needs to be reflected on the report. In most instances, this will be the weight reflected in the matrix for that TAMCN. For some task-organized units, however, this will not be the case. A Marine Expeditionary Unit (MEU) is a task-organized unit made up of different communities. The unit is comprised of detachments from the division, FSSG, and SRIG. In this case, the TAMCN community criticality weight will be an average value derived from the summation of criticality weights of all the communities that possess the item, divided by the total quantity. The following example illustrates this point.

The 22 MEU rates 14 A2167, AN/VRC-88As. The following illustrates the distribution of this item among the different MEU communities along with the associated community criticality weight, per Appendix C:

<u>Detachment Type</u>	<u>Qty</u>	<u>CC Weight</u>
MEU Headquarters	2	1
Infantry Battalion	6	2
Artillery Battery	1	3
AAV Company	1	2
MEU Service Support Element	2	3
Communications Detachment	2	1

In this example, the 22 MEU LM2 report would reflect a TAMCN community criticality weight for A2167 of  $[(2*1)+(6*2)+(1*3)+(1*2)+(2*3)+(2*1)]/14 = 27/14 = 1.93$ . If the artillery battery's or the MEU Service Support Element's AN/VRC-88A becomes deadlined, it would have a larger negative impact on 22 MEU's equipment readiness than if one were to be placed in a non-mission capable status belonging to the communications detachment.

A field entitled "TAM CC WT" should appear between the Excess Quantity and the Deadlined Serial Number fields. The value placed in this field will reflect the average community criticality weight of the respective TAMCN for that unit. Except in the instance of a task-organized unit, this will simply be the community criticality weight reflected in the matrix for that TAMCN. Figure 4.1 displays the modified notional LM2 report.

Notice the end item R rating is slightly different than that reflected in Figure 2.1, due to the new computation. The new R rating formula discussed in Chapter III is displayed at the bottom of Figure 4.1, along with the old S rating formula. If we multiply the possessed quantity for each TAMCN by the respective TAM criticality

Figure 4.1. Modified Notional LM2 Report

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MARES LM2 UNIT REPORT  
HQ 19TH MAR

DATE 96/126

UIC PAGE 1 MC PAGE 56

Figure 4.1 (Continued)

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Figure 4.1 (Continued)

UIC M12301										MAJOR CMD M12000								
TAM NUMBER	TAM NOMENCLATURE	REPT AUTH	REPT POSS	EXCESS QTY	TAM CC WT	DEADLINED-EQUIP		CC WT	ORIGINAL DATE-DL	DATE-OF PRES-COND	PRES COND	PRES EOM	PRESENT HOLDER	STATUS DAYS	ERO NO			
										SERIAL-NO	ID-NO							
E1210	PADS AN USQ-70	3	5	2	1.0	0202 0209	8837A 8837A	1 1	96/122 96/216	96/122 96/218	NMCM NMCS	2 3	M12301 M22910	004 273	WW285 LAE95			
REMARKS ABOUT TAM																		
T/E-003 T/E EXCESS QTY 002 PENDING MOA																		
TOTALS FOR THIS UIC ARE				179	180	3	QTY DL = 11											
<div style="border: 1px solid black; padding: 10px;"> <b>END ITEM READINESS</b>            S RATING EQUALS 98.87 PERCENT            R RATING EQUALS 93.12 PERCENT         </div>																		
S RATING = $\frac{\text{POSS-EXCESS}}{\text{AUTH}}$ R RATING = $\frac{\text{POSS WT - D/L WT}}{\text{POSS WT}}$																		

weight and sum them, we get a POSS WT of 396. Summing up the criticality weights of the deadlined equipment gives us a DL WT of 27. Plugging these values into the R rating formula yields a value of 93.12 percent. We would expect this rating to be slightly lower than the traditional rating since six of the eleven pieces of deadlined equipment have a criticality weight of 3. Notice that there is no longer a need to track pacing item and end item readiness separately since equipment formally flagged as a pacing item is likely to have a community criticality weight of 4 or 3 and its loss will impact the readiness rating at a magnitude commensurate with its importance to the war-fighting ability of the unit.



## **V. METHODOLOGY COMPARISON**

This chapter shows how the proposed methodology of computing readiness ratings differs from the current method. The scenario presented in Chapter II will be reviewed and the new method of computing readiness ratings will be applied. The results will be compared to those generated in the original scenario.

### **A. REVIEW OF THE ORIGINAL SCENARIO**

In Chapter II, we looked at a scenario involving two sister artillery battalions (2/10 and 3/10) that had the same tables of equipment, each consisting of 210 pieces of authorized readiness reportable items. The excesses and deficiencies as well as a list of deadlined readiness reportable equipment, were presented for each unit. Readiness and supply ratings for each battalion were computed based on the current methodology. 2/10 had a pacing item readiness rating of 97.4 percent and an end item readiness rating of 91.94 percent. Those generated for 3/10 were 96.05 percent and 89.9 percent, respectively. Utilizing the current formula for generating readiness ratings, 2/10 reflected better readiness figures than 3/10 for both pacing items and end items.

### **B. APPLICATION OF THE PROPOSED METHODOLOGY TO THE SCENARIO**

In the original scenario, a deadlined item impacted the readiness ratings with equal weight, regardless of the item's relationship to the unit's mission. Considering the level of criticality of a deadlined item in the computation of readiness ratings, may vary the results significantly.

#### **1. Required Additional Information**

Recall that the new formula proposed to generate readiness ratings equals:

$$R \text{ rating} = [(POSS \text{ WT} - DL \text{ WT}) / POSS \text{ WT}]$$

In order to compute a readiness rating under the new methodology, a possessed weight is needed. For the purpose of this example, we will assume the average community criticality weight of an item belonging to the artillery community is 2.2. The authorized possessed weight for each battalion will then equal  $2.2 * 210 = 462$ . This value will require adjustment to accommodate T/E deficiencies and excesses of readiness reportable gear.

Recall that in the original scenario, 2/10 was deficient one E0665, howitzer and was excess one B0953, MEP-005 generator and one D1059, 5-ton truck. Referring to the community versus equipment matrix in Appendix C reveals that these items have community criticality weights of 4, 3, and 1 respectively for the artillery community. Thus, 2/10's possessed weight would equal:

$$462 - 4 + 1 + 3 = \mathbf{462}$$

3/10 was deficient one D1059, 5-ton truck and one A2065, HF radio. These items have community criticality weights of 3 and 2 respectively. 3/10's possessed weight would equal:

$$462 - (3 + 2) = \mathbf{457}$$

## **2. Community Criticality Weights for Deadlined Equipment**

The proposed methodology assigns different weights to readiness reportable equipment depending on the criticality of the item to the organization's wartime mission. These weights will vary from community to community and are depicted in the matrix presented in Appendix C. Utilizing this matrix, Table 5.1 displays the deadlined readiness reportable equipment and associated community criticality weights for 2/10. Those for 3/10 are depicted in Table 5.2.

**Table 5.1. 2/10's Deadlined Equipment and Associated Community Criticality Weight**

TAMCN	Nomenclature	DL QTY	CC WT
A1935	Radio Set, AN/MRC-138B(V)	1	3
A2065	Radio Set, AN/PRC-104	2	2
A2070	Radio Set, AN/PRC-119A	3	3
A2508	Switchboard, SB-3865	1	2
B0891	Generator Set, MEP-003	3	3
D1158	Truck, HMMWV, M998	3	3
E0665	Howitzer, M198	2	4
E1210	AN/USQ-70	1	4
E3250	Radar Chronograph, M-90	1	4

**Table 5.2. 3/10's Deadlined Equipment and Associated Community Criticality Weight**

TAMCN	Nomenclature	DL QTY	CC WT
A2065	Radio Set, AN/PRC-104	1	2
A2069	Radio Set, AN/PRC-113	1	1
A2167	Radio Set, AN/VRC-88A	4	2
A8082	TSEC/KG-84A	6	1
B0953	Generator Set, MEP-005A	3	1
B1021	Generator Set, MEP-006A/B	2	1
D1059	Truck, 5-ton, M813	3	3
E1158	NVG, AN/PVS-4	1	1

### 3. Computation of Readiness Ratings

The deadlined weight will equal the sum of the products of deadlined quantities and the community criticality weight for each TAMCN. For 2/10, this value will equal

$$(1*3) + (2*2) + (3*3) + (1*2) + (3*3) + (3*3) + (2*4) + (1*4) + (1*4) = 52$$

Likewise, 3/10's deadlined weight will equal

$$(1*2) + (1*1) + (4*2) + (6*1) + (3*1) + (2*1) + (3*3) + (1*1) = 32$$

Utilizing the proposed readiness rating formula, the respective possessed weights, and the above deadlined weights, the following readiness ratings for each artillery battalion can be generated:

$$2/10's R rating = (462 - 52) / 462 = 88.74$$

$$3/10's R rating = (457 - 32) / 457 = 93.0$$

### 4. Computation of Supply Ratings

Changes were not proposed to the original formula for the computation of supply ratings. This formula was stated as:

$$S \text{ Rating} = (POSS - EXCESS) / AUTH$$

The supply rating under the new methodology will be the same as the end item S ratings computed under the current method. These values were 99.52 percent and 99.05 percent for 2/10 and 3/10, respectively.

## C. SCENARIO COMPARISON

The current methodology of computing readiness ratings generates higher ratings for both pacing items and end items belonging to 2/10. If we consider the criticality of the deadlined equipment in terms of the organization's mission instead

of simply assuming equal impact on readiness for all reportable equipment, we get some very different results. As illustrated above, 3/10's readiness rating is over 4 percentage points greater than that of 2/10. Should an operational requirement for an artillery battalion arise, a war planner armed with the ratings generated from the proposed method would assume that 3/10's ability to perform its wartime mission is greater than that of 2/10, and 3/10 would be the logical choice for deployment. If we were to examine the deadlined equipment and consider its importance to the wartime mission of an artillery unit, this would be a logical assumption.

The proposed method of computing readiness ratings motivates organizations to allocate maintenance resources towards repairing those items that will provide the greatest contribution to the ability to perform their war-fighting mission. A deadlined item with a community criticality weight of 4 or 3 that is repaired will have a greater improvement on the readiness rating than if an item with a weight of 1 or 2 were to be repaired. Consideration of a deadlined items criticality weight in the computation of readiness ratings encourages the repair of the most critical items over those less critical.

No changes to the current supply ratings computation method were proposed with the exception of eliminating the need to monitor both a pacing item and an end item supply rating. The original S rating formula combined with the proposed method of computing the readiness rating will provide the Marine Corps with the capability to report both the portion of equipment available to the unit, along with the unit's ability to perform its assigned wartime mission which is purported to be the purpose of equipment readiness reporting.

#### **D. GENERATED RATINGS AND SURVEY COMPARISONS**

In this section, scenarios were presented from four different communities. In each, a list of deadlined readiness reportable equipment was provided from two sister

units belonging to the same community, similar to the artillery scenario introduced in Chapter II. Additionally, each scenario contained the authorized quantities of readiness reportable equipment and a possessed weight, representing the sum of the product of the quantities multiplied by the community criticality weight for each TAMCN authorized to the unit. Without revealing any supply or readiness ratings, USMC officers were asked to look at the lists of deadlined equipment for each scenario and indicate which organization he/she considered more capable of accomplishing its wartime mission. Ratings were then generated using both methodologies and compared to the survey results.

### **1. Scenarios To Be Considered**

A list of deadlined equipment from two units belonging to the same community and having identical T/Es was provided for each scenario. Assumptions included that there were no deficiencies and the quantity deadlined for each item equaled one. The following four scenarios were considered for the purpose of this survey:

- **Infantry Community** - authorized 89 pieces of readiness reportable equipment and a possessed weight of 186.9

	<b>Unit "A"</b>	<b>Unit "B"</b>
A2065	Radio Set, AN/PRC-104	A1935 Radio Set, AN/MRC-138B (V)
A2298	MX-9331B/URC	A2069 Radio Set, AN/PRC-113(V)3
A2508	Switchboard, SB-3865	D1059 Truck, 5-ton, M813
A8089	TSEC/KG-194A	D1158 Truck, HMMWV, M998
D0880	Water Bull, M149A2	E0994 MG, 40MM, MK-19, Mod-3
D1159	Truck, HMMWV, M1043	E1065 Mortar, 60MM, M224

E0180 Circle, Aim, M2A2	E1095 Mortar, 81MM, M252
E1045 MULE, AN/PAQ-3	E1460 Sniper Rifle, M40A1
E1158 NVG, AN/PVS-4	
E1912 FLD TEST SET, TOW	
E3175 SU-36/P	

- **Amphibious Assault Community** - authorized 96 pieces of readiness reportable equipment and a possessed weight of 211.2.

<b>Unit "A"</b>	<b>Unit "B"</b>
A2065 Radio Set, AN/PRC-104	A2070 Radio Set, AN/PRC-119A
A2505 Switchboard, SB-3614(V)TT	A2164 Radio Set, ANVRC-83(V)2
A8082 TSEC/KG-84A	D0209 Power Unit, MK48, Mod 0
B0891 Generator, MEP-003A	D0876 Trailer, Powered, MK14, Mod 0
B2567 Tractor, AT 644E	E0846 AAVP7A
D1002 Truck, Ambulance, M1035	E0997 MG, 40MM, MK-19, Mod-3
D1212 Truck, Wrecker, M816	
E0980 MG, .50 Cal, M2	
E0997 MG, M60D	
E1045 MULE, AN/PAQ-3	

- **Combat Engineer Community** - authorized 75 pieces of readiness reportable equipment and a possessed weight of 161.3.

<b>Unit "A"</b>	<b>Unit "B"</b>
A1935 Radio Set, AN/MRC-138B(V)	A2298 MX-9331B/URC
B1021 Generator, MEP-006A/B	A2505 Switchboard, SB-3614 (V)
B1298 Line Charge Launch Kit	A8082 TSEC/KG-84A
D1059 Truck, 5-ton, M813	B0891 Generator, MEP-003A
D1072 Truck, Dump, M817	B2604 ROWPU
E0980 MG, .50 Cal, M2	D0877 Trailer, Powered, MK15
	D1158 Truck, HMMWV, M998
	E0915 MK153 Mod 0
	E1159 AN/TVS-5

- **Motor Transport Community** - authorized 82 pieces of readiness reportable equipment and a possessed weight of 177.

<b>Unit "A"</b>	<b>Unit "B"</b>
A2065 Radio Set, AN/PRC-104	A1935 Radio Set, AN/MRC-138B(V)
A2167 Radio Set, AN/VRC-88A	D0209 Power Unit, MK48, Mod 0
D0880 Water Bull, M149A2	D0876 Trailer, Powered, MK14
D0881 Trailer, Ribbon, MK18	D1059 Truck, 5-ton, M813
D1158 Truck, HMMWV, M998	E0994 MG, 40MM, MK-19, Mod-3
E0989 MG, M240G	

E1158 NVG, AN/PVS-4

E1159 AN/TVS-5

End item readiness ratings were computed for each scenario using both the current and proposed methodologies and displayed in Table 5.3.

## 2. Survey of USMC Officers

The four fictitious scenarios were presented in a survey administered to 50 USMC ground officers currently assigned to NPS. Participants were asked to examine the lists of deadlined equipment from the four communities and indicate which unit was considered more capable for each scenario. No readiness ratings were provided. Appendix D contains a copy of the survey and Table 5.3 contains the percentage of officers that indicated which unit was considered more capable for each scenario.

**Table 5.3 Readiness Ratings and Survey Results**

Scenario	Unit	Current Rating	Proposed Rating	Survey Results
1 (Infantry)	A	87.6	93.6	78
	B	91.0	87.7	22
2 (Amphibious Assault)	A	89.6	95.3	72
	B	93.7	91.9	28
3 (Combat Engineer)	A	92.0	89.5	22
	B	88.0	93.2	78
4 (Motor Transport)	A	90.2	94.9	92
	B	93.9	91.5	08

### **3. Comparison Between Computed Ratings and Survey Results**

The survey results support the premise that the proposed method does a better job of reflecting war-fighting ability than the current readiness rating method. For each scenario, the unit that the majority of Marine Corps officers felt was more capable of accomplishing their mission reflected a lower readiness rating when generated from the current methodology. When the criticality of the deadlined item was considered in the computation of readiness ratings, as it was under the proposed method, the results were directly in line with the majority opinion regarding war-fighting ability.

### **E. OPPORTUNITIES FOR GAMING**

It would be naive to think that the proposed method for computing the readiness rating was not susceptible to gaming or manipulation by field commands. The establishment of community criticality weights used in the "R" rating formula are based on the prioritized rankings of readiness reportable equipment as determined by FMF ground communities. Should a commander be more interested in simply reflecting a high readiness rating instead of one that reflects the organization's true war-fighting capability, he/she might be tempted to submit prioritized rankings that do not correlate to criticality of need. A weapon system that is maintenance intensive and often deadlined might be ranked low, regardless of its importance to the wartime mission of the community, so a small criticality weight will be assigned. On the other hand, a reliable piece of equipment that is seldom in a non-mission capable maintenance status might be ranked artificially high so it will assume a larger criticality weight. It will be incumbent upon the major subordinate command and MEF headquarters elements to be vigilant when reviewing community prioritized rankings of reportable equipment to ensure this has not occurred, prior to submitting them to HQMC.

## VI. CONCLUSIONS AND RECOMMENDATIONS

### A. CONCLUSIONS

The current method of computing ground equipment readiness employed by the Marine Corps is not compatible with the Marine Corps' definition of equipment readiness. The figures generated by the current formula do not correlate to the organization's ability to execute its war-fighting mission, but merely articulate the fraction of readiness reportable equipment that is in a mission capable status. The magnitude of the impact that a deadlined item has on an organization's equipment readiness rating should be relative to the criticality of that item in terms of the organization's assigned wartime mission. The current methodology only permits deadlined items to impact readiness ratings with an equal weight. Furthermore, the current method fails to incentivize the accomplishment of repairs on the more critical items over those that are less vital to the war-fighting capability of the organization.

This thesis proposed a method of assigning community criticality weights to readiness reportable equipment and considering those weights in the computation of readiness ratings in order to generate a rating that reflects true war-fighting ability instead of a mere percentage of available equipment. This method also provides incentives for commanders to allocate maintenance resources towards the repair of those items that will provide the maximum benefit to the fighting capability of the unit.

A part of the Marine Corps' definition of equipment readiness involves reflecting the portion of authorized equipment available for an organization's use. The current formula used to generate supply ratings computes the percentage of authorized equipment that is possessed by the unit, which does an adequate job of satisfying this part of the equipment readiness definition.

## **B. RECOMMENDATIONS**

### **1. Incorporate Community Criticality Weights When Computing Readiness Ratings**

The premise of this thesis is that different readiness reportable items impact a unit's ability to function with varying magnitudes and that these magnitudes need to be considered when computing readiness ratings. The purpose of determining community criticality weights was to capture this magnitude that each readiness reportable item has on the different USMC ground community's ability to function. The Marine Corps needs to adopt this concept of assigning community criticality weights to all readiness reportable items.

The current methodology used to compute readiness ratings needs to be modified in order to consider the community criticality weight of a deadlined item. Chapter III discussed a new R rating formula designed to accomplish this exact task. In Chapter IV, modifications to the LM2 report were proposed in order to accommodate this new methodology which involved the addition of two new fields. It is recommended that the Marine Corps utilize this new formula for computing ground readiness ratings and make the suggested changes to the LM2 report format.

### **2. Cease Tracking Both Pacing Item and End Item Ratings**

The Marine Corps currently tracks readiness and supply ratings for both pacing items and end items. The rating that is the lowest of the two gets reported up the chain of command as the equipment readiness input for SORTS. With the proposed methodology, there is no longer a requirement to track two sets of ratings. A deadlined item will influence the readiness rating by a magnitude that is commensurate to the item's community criticality weight. The critical nature of pacing items will insure that they are always assigned high criticality weights and will, therefore, have a heavy impact on readiness. With the adoption of the proposed method of computing readiness ratings, only one set of ratings is generated and required.

### **3. Decentralize the Determination of Community Criticality Weights**

The three active Marine Expeditionary Forces (MEF) are strategically located throughout the globe. Each has a unique area of operation. The missions and priorities of each MEF are dictated by the threats and challenges present in that area. One master set of community criticality weights for the entire Marine Corps would not address these differences in priorities. It is recommended that each MEF be permitted to develop their own set of community criticality weights.

### **4. Annually Solicit Modifications to Established Community Criticality Weights**

The Marine Corps operates in a very dynamic environment. The world around it is constantly changing along with the threats and missions that the Corps must be ready to face. New equipment is being developed and fielded on a regular basis. Changes in domestic social and political pressures cause fluctuations in personnel end strengths. It is important that community criticality weights assigned to readiness reportable equipment be periodically reviewed and adjusted as required. The Marine Corps currently conducts an annual solicitation for changes to the list of items considered readiness reportable. It is recommended that each MEF solicit adjustments to the community rankings of readiness reportable equipment in conjunction with this annual update and modify respective weights as required.

## **C. OPPORTUNITIES FOR FURTHER STUDY**

### **1. Inventory Protection Levels**

Inventories of repair parts needed by the MEF ground communities are maintained within the SASSY Management Unit (SMU) of each FSSG. The stockage levels of these repair parts are determined by examining historical usage and applying an 85 percent protection level [Ref. 15]. This protection level is used consistently for all repair items regardless of the end item to which they apply. A review of the

community criticality weights assigned to readiness reportable equipment might provide a way to logically vary this protection level to provide better support to the most critical items. If we average the criticality weights of a piece of equipment across all the communities that rate the item, we can develop a sense of how critical the item is to the MEF as a whole. For instance, the TSEC/KG-84A, TAMCN A8082, is rated by 14 of the ground communities and has an average criticality weight of 1.07. An 85 percent protection level for the stockage of the critical repair parts that support this item might be acceptable. On the other hand, the AN/MRC-138B(V), TAMCN A1935, is rated by 16 communities and has an average criticality weight of 2.75. A higher protection level, perhaps 90 percent, might be warranted for the stockage of the critical repair parts that support this item. The tank community is the only community that rates the M1A1 main battle tank, TAMCN E1888, and as might be expected, this item has a community criticality weight of 4. The critical repair parts that support this item might require stockage at a 95 percent protection level.

## **2. Incorporation of Fiscal Data Into Reported Readiness Ratings**

This thesis proposes a new method of computing equipment readiness figures and provides for the reporting of only one set of ratings, an S and R rating. Interfacing the LM2 report with fiscal information would provide a third rating that might prove very useful to war planners. In addition to the S and R ratings, a fiscal rating displaying the dollar value required to bring a unit's equipment readiness to the highest level possible along with the associated rating could easily be generated.

All repair parts in the Marine Corps supply system have an associated Combat Essential-Criticality Code (CE-CC) that identifies the importance of the repair part in relation to the proper functioning of the end item. A CE-CC of 5 identifies a critical repair part belonging to a readiness reportable piece of equipment [Ref. 16:p. 4-4-20]. The Master Header Information File (MHIF) is a large database managed

by the Marine Corps Logistics Base (MCLB) in Albany, Georgia that contains the current price for every item that can be requisitioned in the Marine Corps supply system, including repair parts. This file is updated on a monthly basis. A fiscal rating could be generated which reflects the dollar value for all CE-CC 5 repair parts on order for the unit as well as the price of any T/E deficiencies of readiness reportable gear, thereby displaying the cost required to restore the unit's equipment readiness rating to the highest level materially possible. The potential readiness rating could accompany the fiscal rating. It should be noted that a unit would be precluded from achieving a potential readiness rating of 100 percent if there were any deadlined items reported on the unit's LM2 report in an NMCM status, which would indicate that something other than the need of a repair part is causing the item to be deadlined.



**APPENDIX A. COMMUNITIES AND ASSOCIATED TABLES OF EQUIPMENT**

<u>Community</u>	<u>T/E Number</u>	<u>T/E Descriptive Name</u>
Division Headquarters	N101*	HQBN, 1ST MARDIV, FMF
	N102*	HQBN, 2ND MARDIV, FMF
	N103*	HQBN, 3RD MARDIV, FMF
Infantry	N111*	INFREGT, 1ST MARDIV
	N112*	INFREGT, 2ND MARDIV
	N113*	INFREGT, 3RD MARDIV
Artillery	N116*	INFBN, INFREGT, 1ST MARDIV
	N117*	INFBN, INFREGT, 2ND MARDIV
	N118*	INFBN, INFREGT, 3RD MARDIV
Artillery	N210*	ARTYREGT, 1ST MARDIV
	N2110	D/S(T)BN, ARTYREGT, 1ST MARDIV
	N220*	ARTYREGT, 2ND MARDIV
Artillery	N2210	D/S(T)BN(M198), ARTYREGT, 2ND MARDIV
	N230*	ARTYREGT, 3D MARDIV
	N2310	D/S(T)BN(M198), ARTYREGT, 3D MARDIV
Tank	N151*	1ST TANKBN, 1ST MARDIV
	N152*	2ND TANKBN, 2ND MARDIV
Assault Amphibian	N161*	ASLT AMPHIBBN, 1ST MARDIV
	N162*	ASLT AMPHIBBN, 2D MARDIV
Light Armored Reconnaissance	N171*	LIGHT ARMORED INFBN, 1ST MARDIV
	N172*	LIGHT ARMORED INFBN, 2ND MARDIV
Combat Engineer	N131*	COMBAT ENGRBN, 1ST MARDIV
	N132*	COMBAT ENGRBN, 2ND MARDIV
	N133*	COMBAT ENGRBN, 3D MARDIV
FSSG Headquarters	N311*	H&SBN, 1ST FSSG
	N321*	H&SBN, 2ND FSSG
	N331*	H&SBN, 3D FSSG

Supply	N312*	SUPBN, 1ST FSSG
	N322*	SUPBN, 2ND FSSG
	N332*	SUPBN, 3D FSSG
Maintenance	N313*	MAINTBN, 1ST FSSG
	N323*	MAINTBN, 2ND FSSG
	N333*	MAINTBN, 3D FSSG
Landing Support	N314*	LDGSPTBN, 1ST FSSG
	N324*	LDGSPTBN, 2ND FSSG
Engineering Support	N315*	ENGRSPTBN, 1ST FSSG
	N325*	ENGRSPTBN, 2ND FSSG
	N335*	ENGRSPTBN, 3D FSSG
Motor Transport	N316*	MTBN, 1ST FSSG
	N326*	MTBN, 2ND FSSG
Medical	N317*	MEDBN, 1ST FSSG
	N327*	MEDBN, 2ND FSSG
	N337*	MEDBN, 3D FSSG
SRIG Headquarters	N4601	HDQTRS, 1ST SRI GROUP
	N4701	HQCO, 2D SRI GROUP
	N4801	HDQTRS, 3D SRI GROUP
Intelligence	N4617	INTELCO, 1ST SRI GROUP
	N4717	INTELCO, 2D SRI GROUP
	N4807	HQS, INTELCO, 3D SRI GROUP
Force Reconnaissance	N4618	FORCE RECON CO, 1ST SRI GROUP
	N4718	FORCE RECON CO, 2D SRI GROUP
ANGLICO	N4654	ANGLICO, 1ST SRI GROUP
	N4754	ANGLICO, 2D SRI GROUP
Signals Intelligence	N463*	1ST RADIO BN
	N473*	RADIOBN, 2D SRI GROUP
Communications	N468*	COMMBN, 1ST SRI GROUP
	N478*	COMMBN, 2D SRI GROUP
	N488*	COMMBN, 3D SRI GROUP

\*Universal character

## APPENDIX B. COMMUNITY ADVOCATES

<u>Community</u>	<u>Points of Contact</u>
Division Headquarters	MGySgt P. Krachenfels, 1st MarDiv, MMO
Infantry	1stLt L. V. Parker, 1st Mar Regt, MMO
Artillery	Maj M. P. Wynn, 11th Mar Regt, S-4 Capt T. B. Dentry, 10th Mar Regt, MMO Capt M. W. Shellabarger, 11th Mar Regt, MMO
Tank	1stLt A. C. Eanniello, 1st Tank Bn, MMO GySgt A. Ramos, 1st Tank Bn, MMC
Light Armored Reconnaissance	1stLt A. S. Church, 1st LAR Bn, MMO GySgt D. E. Askew, 1st LAR Bn, MMC
Assault Amphibious	1stLt H. R. Blake, 3rd AABn, MMO GySgt P. T Bell, 3rd AABn, MMC
Combat Engineers	Maj D. W. Sapp, 1st Combat Engr Bn, XO
FSSG Headquarters	MSgt J. M. Powers, 1st FSSG, MMC SSgt L. R. Wolfe, H&S Bn, 1st FSSG, MMC
Maintenance	SSgt M. J. Nemerov, 1st Maint Bn, MMC
Landing Support	Maj D. A. Ingebretsen, 1st Landing Supp Bn, XO Capt D. M. Hyde, 1st Landing Supp Bn, MMO
Engineer Support	1stLt M. C. Varicak, 7th Engr Supp Bn, S-4
Supply	CWO3 D. L. Cowley, 1st Supp Bn
Motor Transport	MSgt A. W. Joy, 7th Mtr Trsnsp Bn, MMC GySgt J. R. Javier, 7th Mtr Transp Bn, Truckmaster

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Medical	1stLt G. McLain, 1st Medical Bn, S-4
SRIG Headquarters	SSgt A. F. Cassagnol, 1st SRIG
Signals Intelligence	Capt M. Ferace, 2nd Radio Bn, S-3
Communications	CWO3 M. E. Gribben, 9th Comm Bn MSgt Dierig, 9th Comm Bn, MMC
Intelligence	SSgt F. Braneski, 1st Intel Co, S-4
ANGLICO	1stLt S. D. Burke, 1st ANGLICO, S-4
Force Reconnaissance	1stLt C. R. McGregor, 1st For Recon Co, S-4

## **APPENDIX C. COMMUNITY CRITICAL BY WEIGHTS**







## APPENDIX D. USMC OFFICER SURVEY

Each scenario below contains lists of readiness reportable equipment that is deadlined for two units belonging to the same community and having identical T/Es. Indicate, by circling, the unit which you consider more capable of accomplishing its wartime mission for all four scenarios.

### Infantry Community

<b>Unit "A"</b>	<b>Unit "B"</b>
A2065 Radio Set, AN/PRC-104	A1935 Radio Set, AN/MRC-138B (V)
A2298 MX-9331B/URC	A2069 Radio Set, AN/PRC-113(V)3
A2508 Switchboard, SB-3865	D1059 Truck, 5-ton, M813
A8089 TSEC/KG-194A	D1158 Truck, HMMWV, M998
D0880 Water Bull, M149A2	E0994 MG, 40MM, MK-19, Mod-3
D1159 Truck, HMMWV, M1043	E1065 Mortar, 60MM, M224
E0180 Circle, Aim, M2A2	E1095 Mortar, 81MM, M252
E1045 MULE, AN/PAQ-3	E1460 Sniper Rifle, M40A1
E1158 NVG, AN/PVS-4	
E1912 FLD TEST SET, TOW	
E3175 SU-36/P	

### Amphibious Assault Community

<b>Unit "A"</b>	<b>Unit "B"</b>
A2065 Radio Set, AN/PRC-104	A2070 Radio Set, AN/PRC-119A
A2505 Switchboard, SB-3614(V)TT	A2164 Radio Set, ANVRC-83(V)2
A8082 TSEC/KG-84A	D0209 Power Unit, MK48, Mod 0
B0891 Generator, MEP-003A	D0876 Trailer, Powered, MK14, Mod 0
B2567 Tractor, AT 644E	E0846 AAVP7A
D1002 Truck, Ambulance, M1035	E0997 MG, 40MM, MK-19, Mod-3
D1212 Truck, Wrecker, M816	
E0980 MG, .50 Cal, M2	
E0997 MG, M60D	
E1045 MULE, AN/PAQ-3	

### **Combat Engineer Community**

<b>Unit "A"</b>	<b>Unit "B"</b>
A1935 Radio Set, AN/MRC-138B(V)	A2298 MX-9331B/URC
B1021 Generator, MEP-006A/B	A2505 Switchboard, SB-3614(V)TT
B1298 Line Charge Launch Kit	A8082 TSEC/KG-84A
D1059 Truck, 5-ton, M813	B0891 Generator, MEP-003A
D1072 Truck, Dump, M817	B2604 ROWPU
E0980 MG, .50 Cal, M2	D0877 Trailer, Powered, MK15,Mod 0
D1158 Truck, HMMWV, M998	
E0915 MK153 Mod 0	
E1159 AN/TVS-5	

### **Motor Transport Community**

<b>Unit "A"</b>	<b>Unit "B"</b>
A2065 Radio Set, AN/PRC-104	A1935 Radio Set, AN/MRC-138B(V)
A2167 Radio Set, AN/VRC-88A	D0209 Power Unit, MK48, Mod 0
D0880 Water Bull, M149A2	D0876 Trailer, Powered, MK14 Mod 0
D0881 Trailer, Ribbon, MK18	D1059 Truck, 5-ton, M813
D1158 Truck, HMMWV, M998	E0994 MG, 40MM, MK-19, Mod-3
E0989 MG, M240G	
E1158 NVG, AN/PVS-4	
E1159 AN/TVS-5	

## APPENDIX E. GLOSSARY

AMRR	Aircraft Material Readiness Report
CC WT	Community Criticality Weight
CE-CC	Combat Essential - Criticality Code
EOM	Echelon of Maintenance
ERO	Equipment Repair Order
FMF	Fleet Marine Force
FSSG	Force Service Support Group
HMMWV	High Mobility Multi-Wheeled Vehicle
HQMC	Headquarters Marine Corps
ID-NO	Item Designator Number
JCS	Joint Chiefs of Staff
LM2	USMC Equipment Readiness Report
MAGTF	Marine Air Ground Task Force
MARES	Marine Corps Automated Readiness Evaluation System
MCBul	Marine Corps Bulletin
MCCDC	Marine Corps Combat Development Command
MCLB	Marine Corps Logistics Base
MEU	Marine Expeditionary Unit
MHIF	Master Header Information File
MIMMS	Marine Corps Integrated Maintenance Management System
MMC	Maintenance Management Chief
MMO	Maintenance Management Officer
MOOTW	Military Operations Other Than War
NMCM	Not Mission Capable Maintenance
NMCS	Not Mission Capable Supply
RM4	LM2 Report Remark
SASSY	Supported Activity Supply System
SMU	SASSY Management Unit
SORTS	Status of Resources and Training System
SRIG	Surveillance, Reconnaissance, and Intelligence Group
TAMCN	Table of Authorized Materiel Control Number
T/E	Table of Equipment
T/O	Table of Organization
UIC	Unit Identification Code
USMC	United States Marine Corps



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MCCDC, Code C45  
300 Russell Rd.  
Quantico, VA 22134-5130
7. Director, LP Division ..... 1  
Clarendon Square Bldg (Code LPP-1)  
3033 Wilson Blvd.  
Arlington, VA 22201-3803
8. Maj Kevin McConnel, USMC ..... 1  
USMC Artillery Detachment  
Fort Sill, OK 73503-5600

9.	Prof. David Matthews (Code SM/Md) .....	2
	Naval Postgraduate School	
	Monterey, CA 93943-5103	
10.	Prof. Keebom Kang (Code SM/Kk) .....	1
	Naval Postgraduate School	
	Monterey, CA 93943-5103	
11.	Thomas W. Russell .....	2
	CMC (Attn: Fiscal Division)	
	HQMC Code RF	
	Washington, DC 20381-0001	